

REMARKS

STATUS OF THE CLAIMS

Claims 1-19 are pending in this application. Claims 4 and 20-42 have been canceled without prejudice. Claims 1-3, 9, 10, 16, and 17 have been amended. Following entry of the amendments, claims 1-3 and 5-19 will be pending and at issue. No new matter is added.

SUPPORT FOR CLAIM AMENDMENTS

Support for the amended claims can be found throughout the specification and claims as filed, and thus, no new matter is added by way of these amendments.

Claims 1-3, 9, 10, 16, and 17 have been amended and now recite a bimetallic or trimetallic metalorganic layer. Support for amended claims 1-3, 9, 10, 16, and 17 is found at least at paragraphs [0044] and [0045] of the specification as filed.

Claim 1 has been amended to provide that the bimetallic or trimetallic metalorganic layer comprises an organic portion and an inorganic portion. Support for amended claim 1 is found at least at paragraph [0049] of the specification as filed.

Claims 1 and 9 have been amended and now recite that the organic portion of the bimetallic or trimetallic metalorganic layer is pyrolyzed to form a growth catalyst on the substrate. Support for amended claims 1 and 9 is found at least at paragraphs [0049], [0056], and [0057] of the specification as filed.

Claim 1 has been amended to incorporate elements of original claim 4 and now provides that the bimetallic or trimetallic metalorganic layer has a thickness of about 1 micron to about 30 microns. Support for amended claim 1 is found at least at original claim 4.

Claim 1 has been amended to reincorporate the element of forming a growth catalyst on a substrate, which was inadvertently removed in the previous claim amendment. Support for amended claim 1 is found at least at original claim 1.

Claim 16 has been amended for clarity and consistency of claim language and now provides that the metalorganic layer is produced by deposition of a metalorganic substance and that the metalorganic substance is purified prior to deposition. Support for amended claim 16 is found at least at Example 1.

REJECTIONS UNDER 35 U.S.C. § 112

Claims 1-19 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 2, 3, 9, 10, 16, and 17 have been amended and now recite a bimetallic or trimetallic metalorganic layer. Thus, these claims are not indefinite with respect to the term “metalorganic layer”. Claim 1 has been amended to provide that the bimetallic or trimetallic metalorganic layer comprises an organic portion and an inorganic portion. Thus, claim 1 is not indefinite with respect to the term “organic portion”. Claim 1 has been amended and now recites that the organic portion of the bimetallic or trimetallic metalorganic layer is pyrolyzed to form a growth catalyst on the substrate. Thus, claim 11 is not indefinite with respect to the term “growth catalyst”. Claim 16 has been amended and now provides that the metalorganic layer is produced by deposition of a metalorganic substance and the metalorganic substance is purified prior to deposition. Thus, claim 16 is not indefinite with respect to the term “metalorganic substance”.

Therefore, the examiner is respectfully requested to withdraw the rejection of claims 1-19 under 35 U.S.C. 112, second paragraph.

REJECTIONS UNDER 35 U.S.C. § 103

Claims 1, 3-15, and 17-19

Claims 1, 3-15, and 17-19 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,232,706 to Dai et al. (“Dai”) in view of U.S. Patent App. Pub. No. 2002/0036452 to Muroyama et al. (“Muroyama”) and further in view of U.S. Patent No. 6,692,717 to Smalley et al. (“Smalley”).

Applicant traverses this ground of rejection by amendment and argument. As described in detail below, the combination of references cited by the Office Action fails to teach each and every element of the presently claimed invention, and the references teach away from the claimed invention.

Dai discloses a method of making carbon nanotube bundles using an iron oxide catalyst disposed on a substrate, wherein the iron oxide catalyst is oxidized after deposition. Dai does not disclose a method for synthesizing carbon nanostructures comprising providing a bimetallic or trimetallic metalorganic layer on a substrate and pyrolyzing the organic portion of the metalorganic layer. Dai also does not disclose (nor does the Office Action assert that it does) that the thickness of the bimetallic or trimetallic metalorganic layer has a thickness of between about 1 micron and about 30 microns. Independent claim 1 recites a method for synthesizing carbon nanostructures comprising providing a bimetallic or trimetallic metalorganic layer on a substrate. Applicant has amended claim 1 to recite that the organic portion of the bimetallic or trimetallic metalorganic layer on a substrate is pyrolyzed and that the bimetallic or trimetallic metalorganic layer has a thickness of between about 1 micron and about 30 microns. Specifically, Dai fails to disclose the use of a bimetallic or trimetallic metalorganic having the claimed thickness. Because Dai fails to teach all of the elements of the present claimed method, it does not itself render the claims obvious.

Muroyama does not overcome the deficiencies of Dai. Muroyama discloses a method of growing a carbon film using a thin layer of an organometallic catalyst. However, at no point does Muroyama disclose a method for synthesizing carbon nanostructures comprising providing a bimetallic or trimetallic metalorganic layer on a substrate and pyrolyzing the organic portion of the metalorganic layer. Moreover, as indicated by the Office Action, Muroyama fails to disclose that the bimetallic or trimetallic metalorganic layer has a thickness of between about 1 micron and about 30 microns (Office Action, page 6). In particular, each of the metal layers disclosed by Muroyama are in the sub-micron range (see e.g., Muroyama, page 11, paragraph [0145]; pages 13-14, paragraph [0170]; page 16, paragraph [0209]; and page 26, paragraph [0332]). Independent claim 1 recites a method for synthesizing carbon nanostructures comprising providing a bimetallic or trimetallic metalorganic layer on a substrate. Applicant has amended claim 1 to recite that the organic portion of the bimetallic or trimetallic metalorganic layer on a substrate is pyrolyzed and that the bimetallic or trimetallic metalorganic layer has a thickness of between about 1 micron and

about 30 microns. Specifically, the combination of Dai and Muroyama fails to teach a bimetallic or trimetallic metalorganic layer that is pyrolyzed having a thickness of between about 1 micron and about 30 microns. Therefore, the combination of Dai and Muroyama does not teach all of the claim elements, the combination cannot render the claims obvious.

Smalley does not overcome the deficiencies of the combination of Dai and Muroyama. Smalley discloses a method of making single wall carbon nanostructures from metal particles. However, at no point does Smalley disclose a method for synthesizing carbon nanostructures comprising providing a bimetallic or trimetallic metalorganic layer on a substrate and pyrolyzing the organic portion of the metalorganic layer wherein the metalorganic layer has a thickness of between about 1 micron and about 30 microns. Like Dai and Muroyama, Smalley does not disclose the presently claimed metalorganic layer thickness. For instance, Smalley discloses transition metal clusters having a size from about 0.5 nm to over 30 nm and indicates that larger clusters are inactivated by its process (Smalley, column 6, lines 51-56). Applicant has amended claim 1 to recite that the organic portion of the bimetallic or trimetallic metalorganic layer on a substrate is pyrolyzed and that the bimetallic or trimetallic metalorganic layer has a thickness of between about 1 micron and about 30 microns. Specifically, the combination of Dai, Muroyama, and Smalley fails to teach bimetallic or trimetallic metalorganic layers having a thickness of between about 1 micron and about 30 microns. Therefore, the combination of Dai, Muroyama, and Smalley does not teach all of the claim elements and the combination cannot render the claims obvious.

The Office Action alleges that it would have been obvious to one of ordinary skill in the art to modify the thickness of the metalorganic layer to between 1-30 microns as presently claimed absent a showing of criticality for the claimed values (Office Action, page 6). Applicant strongly disagrees with the examiner and directs the examiner to pages 22-23, paragraphs [0056] and [0057] of the specification as filed. In these paragraphs, the applicant demonstrates that the claimed thickness has a significant effect on the properties of the carbon nanostructures formed. Optimization of this thickness involves non-routine experimentation given the complexity of the system, and thus, it was not obvious to try the presently claimed metalorganic layer thicknesses. Moreover, each of the references cited by the Office Action, teach away from the presently claimed metalorganic layer thicknesses. For instance, Dai indicates that the film is preferably 5 nm (Dai, column 2, lines 53-55) and lists no thickness other than 5 nm (see e.g., Dai, column 5, line 18 and

claim 22). Because Dai suggests that the preferred thickness is 5 nm, it teaches away from the presently claimed thickness of 1-30 microns, which is significantly larger than 5 nm. In addition, each of the metal layers disclosed by Muroyama are in the sub-micron range (see e.g., Muroyama, page 11, paragraph [0145]; pages 13-14, paragraph [0170]; page 16, paragraph [0209]; and page 26, paragraph [0332]). Moreover, Smalley discloses that catalyst particles greater than about 2 nanometers in diameter are more likely to form multiwall nanotubes (Smalley, column 3, lines 51-52). Thus, Smalley teaches away from the presently claimed metalorganic layer having a thickness of between about 1 micron and about 30 microns. Despite the teachings of the cited references, applicant demonstrates formation of single walled nanostructures (i.e., one-dimensional carbon nanostructures) using a metalorganic layer thickness of between 1 micron and 30 microns (see e.g., Example 2). Because each of the cited references teaches that the presently claimed thickness would not be preferred, or would even be inoperable, each of those references teaches away from the presently claimed metalorganic layer thicknesses. Because each of these references teaches away from the presently claimed invention, it would not have been obvious to modify them as suggested by the Office Action to reach the presently claimed invention.

Because the combination of Dai, Muroyama, and Smalley does not teach all of the claim elements and each of the references teaches away from the presently claimed invention, the combination cannot render the claims obvious. Therefore, the examiner is respectfully requested to withdraw the rejection of claims 1, 3-15, and 17-19 under 35 U.S.C. § 103(a).

Claim 2

Claim 2 was rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dai in view of Muroyama and Smalley as applied above and further in view of U.S. Patent No. 5,863,601 to Kikuchi et al. (“Kikuchi”). Applicant traverses this ground of rejection by amendment and argument.

Because claim 2 depends from claim 1, it contains all the elements of claim 1. As discussed above, the combination of Dai, Muroyama, and Smalley does not teach all of the elements of claim 1. Kikuchi does not overcome the deficiencies of the combination of Dai, Muroyama, and Smalley because it also fails to disclose a bimetallic or trimetallic metalorganic layer having a thickness of between about 1 micron and about 30 microns. Accordingly, the combination of Dai, Muroyama,

Smalley, and Kikuchi fails to teach all of the elements of claim 2 and cannot render it obvious. Therefore, the examiner is respectfully requested to withdraw the rejection of claim 2 under 35 U.S.C. § 103(a).

Claim 16

Claim 16 was rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Dai in view of Muroyama and Smalley, and further in view of U.S. Patent No. 4,650,895 to Kadokura et al. (“Kadokura”). Applicant traverses this ground of rejection by amendment and argument.

Because claim 16 depends from claim 1, it contains all the elements of claim 1. As discussed above, the combination of Dai, Muroyama, and Smalley does not teach all of the elements of claim 1. Kadokura does not overcome the deficiencies of the combination of Dai, Muroyama, and Smalley because it also fails to disclose a bimetallic or trimetallic metalorganic layer having a thickness of between about 1 micron and about 30 microns. Accordingly, the combination of Dai, Muroyama, and Kadokura fails to teach all of the elements of claim 16 and cannot render it obvious. Therefore, the examiner is respectfully requested to withdraw the rejection of claim 16 under 35 U.S.C. § 103(a).

CONCLUSION

If the examiner has any questions concerning this Response, the examiner is invited to telephone applicant's representative at (206) 389-4550.

Applicants petition for a three (3) month extension of time in the amount of \$1,110. The Commissioner is hereby authorized to charge Deposit Account 19-2555 for the extension of time fees as well as any additional fees that may be required to render the present submission timely.

Respectfully submitted,

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